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Stomach

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PHYSICIAN TO THE GERMAN DISPENSARY, AND INSTRUCTOR IN CLINICAL MEDICINE
AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL

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A New Method for Direct Electrization of the Stomach.¹

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MR. PRESIDENT AND GENTLEMEN: Numerous experiments have been made in the study of the influence of electricity upon the stomach and intestines; all of them serve to demonstrate the physiological effects of this agent.

Ludwig and Weber,² von Ziemssen³ and Bocci⁴ have stated that on animals the faradic, as well as the galvanic, current, applied directly to the stomach, causes contractions of this organ, and produces secretion of the gastric juice.

Schillbach,⁵ upon applying the galvanic current to the bowels of a rabbit, observed intense contractions at the site of the anode, followed by peristaltic movements. Fubini⁶ lately demonstrated, after making a Vella's

¹ Read before the New York Academy of Medicine, March 5, 1891.

² Ludwig and Weber: Cited from Kussmaul, Arch. f. Psych. und Nerv., 1877, tome viii., p. 205.

³ Von Ziemssen: Klin. Vorträge, No. 12, Die Electricität in der Medicin.

⁴ Bocci: Lo Sperimentale, June, 1881.

⁵ Schillbach: Virch. Arch., Bd. 109, p. 284.

⁶ Fubini: Centralbl. f. d. med. Wissensch., 1882, No. 33, p. 579.



double intestinal fistula, that electricity quickens intestinal peristalsis to a high degree, viz., about five or six times.

The influence of electricity upon the stomach and intestines thus being evident, it is perfectly right to endeavor to make use of this means in the therapeutics of these organs.

For many years past, numerous authors have employed electricity in affections of the stomach and intestines. The method generally used for this purpose consisted in the percutaneous application of the current; usually one electrode was held in the neighborhood of the vertebral column at about the sixth dorsal vertebra on the left side, the second electrode being placed at the epigastrium.

A. D. Rockwell and M. Beard¹ were among the first to make use of electricity on a large scale in the treatment of nervous dyspepsias. To the application of electricity to the stomach they added general electrization, and had the most brilliant results.

Neftel,² in 1876, says: "For more than eight years I used the induced current in the treatment of dilatations of the stomach arising from chronic catarrh, with much success."

Fuerstner³ has treated three cases of suddenly appearing attacks of gastric tympanites in nervous females with the galvanic current, and could always observe an amelioration of the complaints. Each time after the galvanization Fuerstner found the limits of the stomach diminished. Based upon this fact he recommends the same method of treatment in atonic dilatations of the stomach.

Oka and Harada⁴ treated thirteen stomach patients with the faradic current, with the result that five were cured, six improved, and two uninfluenced. Leube,⁵ in

¹ A. D. Rockwell and M. Beard: Philad. Med. Surg. Report., 1868, No. 20, and 1871, p. 470.

² Neftel: Centralbl. f. d. med. Wissensch., 1876, No. 21, p. 370.

³ Fuerstner: Berl. klin. Wochensch., 1876, No. 11.

⁴ Oka and Harada: Berl. klin. Wochensch., 1876, No. 44.

⁵ Leube: Deutsch. Arch. f. klin. Medicin, 1879, tome 23, p. 98.

the treatment of nervous dyspepsia recommends the daily application of electricity. Lente¹ and Semmola² have obtained splendid results by the use of electricity in cases of vomiting of the most various nature. Lente recommends electricity as a cure for sea-sickness, though he has not given the matter a sufficient trial. Richter³ advises the use of electricity in nervous dyspepsia and nervous enteropathy. Leubuscher⁴ speaks highly of the application of the galvanic current in pathological conditions of the lower intestines.

Besides these clinical facts, there have lately been added some more exact notes as regards the physiological effects of percutaneous electricity of the stomach in man. Ewald and myself⁵ have been able to demonstrate an acceleration of the motor faculty of the stomach under the influence of percutaneous faradization, by the appearance of the salol-test in the urine about one-fourth of an hour earlier than otherwise. A. Hoffmann⁶ showed that the galvanic current percutaneously applied in the gastric region for twenty minutes produces an abundant secretion of gastric juice.

Although the favorable influence of electricity, even percutaneously applied, is quite evident in numerous affections of the stomach and intestines, it, however, remains questionable whether any of the produced electricity penetrates to the stomach. The main currents undoubtedly go through the skin and muscles, and if any of them reach the stomach, they must be very weak. But surely we might expect to attain better and more successful results by the application of electricity directly to the stomach. In his celebrated book on "Electrotherapy,"

¹ Lente: Arch. of Electrol. and Neurol., 1874, i., p. 193.

² Semmola: L'elettricit  nel vomito, Gaz. med. Ital. Lombard., 1878, No. 6.

³ Richter: Berl. klin. Wochensch., 1882, Nos. 13 and 14.

⁴ Leubuscher: Centralbl. f. klin. Med., 1887, No. 25.

⁵ Ewald and Einhorn: Verhandlungen des Vereins f r innere Medicin, 1888, p. 58.

⁶ A. Hoffmann: Berl. klin. Wochensch., 1889, Nos. 12 and 13.

Erb¹ says: "The first maxim to observe is the treatment in *loco morbi*, i.e., the application of electricity to the morbid part itself. . . . There is no doubt that it is best, in the great majority of cases, to operate directly on the diseased spot."

Pepper² had a patient with dilatation of the stomach, in whom the abdominal walls were so thin that the spontaneous peristalsis of the stomach could be perceived. On this patient he showed that electricity, percutaneously applied, never produced any peristaltic movements of the stomach. Pepper then continues as follows: "The difficulty of compelling a current, no matter what may be its strength, to penetrate through various layers of tissue of different consistency and anatomical character is well known." Speaking of the percutaneous electricity of the stomach, Kussmaul³ remarks: "The therapeutic results obtained by Fuerstner and others in cases with dilatations of the stomach do not prove that by means of the current a direct peristalsis of the stomach was induced, but could be attributed to the favorable influence of the contractions of the abdominal walls." All the sentences mentioned plead for applying electricity to the stomach directly, and not percutaneously, if possible.

Canstatt⁴ first proposed to combat dilatations of the stomach by direct electrization, introducing one electrode into the œsophagus and putting the other in the stomach region. Duchenne⁵ was the first who made use of this method. Very soon afterward, in 1877, Kussmaul⁶ began to practise the direct electrization of the stomach. The electrode used for the purpose consisted of a stomach-tube, through which ran a copper wire ending in an olive point and fastened to the cut-off end of the tube. In several patients with dilatation of the stomach Kuss-

¹ Erb: Handbuch der Electrotherapie, p. 279.

² Pepper: Philad. Med. Times, May, 1871, p. 274.

³ Kussmaul: Arch. f. Psych. und Nerv., 1877, viii., p. 205.

⁴ Canstatt: Cited from Kussmaul, l. c.

⁵ Duchenne: Cited from Kussmaul, l. c.

⁶ Kussmaul: L. c.

maul introduced this electrode into the stomach, the other (ordinary) electrode being held in the hand. In applying electricity in this way contractions of the abdominal muscles on the left side appeared, and in one patient, with thin abdominal walls, contractions of the stomach were visible on applying weaker electric currents. Kussmaul speaks very highly of this method for the direct electrization of the stomach.

• Later on Balduino Bocci,¹ in 1881, experimenting on animals, was persuaded "that the indirect faradization of the stomach through the abdominal walls produces in the stomach, even when applied in a very energetic way, phenomena of very little importance, and of a dubious curative effect." As the direct faradization of the stomach, on the other hand, showed all the above-mentioned physiological effects, Bocci recommended anew the use of the direct electrization of the stomach for therapeutic purposes. Bocci used for this end an electrode like that of Kussmaul.

Great progress in the direct electrization of the stomach was made in 1884, by G. Bardet.² The direct contact of the lower metal piece of the electrode with the inner wall of the stomach irritates only a small spot, and this very intensely, whereas the larger part of the stomach receives but very little of the electricity produced; in consequence thereof the galvanic current could not be applied, because by the usual method it would not be possible to avoid lesions of the mucous membrane of the stomach. In order to overcome these drawbacks Bardet constructed his stomach electrode in such a way that the metal-piece running through the tube was shorter than the tube, and did not touch its windows. By filling the stomach with water the electric circuit between the stomach-wall and the lower metal-piece of the electrode was established. In this way the electricity was distributed over the whole surface touched by the water. By means

¹ Bocci: *Lo Sperimentale*, June, 1881.

² Bardet: *Bull. Gén. de Thérap.*, 1884, tome 106, p. 529.

of this electrode Bardet treated three cases of dilatation of the stomach, and one case of obstinate vomiting, with the galvanic current (15 to 25 milliampères) and obtained splendid results. Most authors who employed the direct electrization of the stomach have, until now, generally used Bardet's electrode. (Charles G. Stockton's¹ stomach electrode does not differ very much from that of Bardet.)

Although the high value of the direct electrization of the stomach is self-evident, this method did not enter much into practice, because the tube surrounding the electrode had to be kept in the throat during the whole electric session (about ten minutes) and inconvenienced the patient to such a degree that the procedure could be carried out only in people accustomed to lavage of the stomach, and even by them it was disagreeably felt. That is the reason why von Ziemssen² rejected direct electrization of the stomach as being too straining and exhausting. Ewald,³ notwithstanding these difficulties, recommends it. In the same way Charles G. Stockton,⁴ in his elaborate paper entitled, "Clinical Results of Gastric Faradization," highly recommends the use of direct electricity in cases of dilatations of the stomach and in many functional disturbances of this organ. Boas,⁵ on the other hand, is conservative as regards the use of direct electricity for the stomach. This author gives in his book, "Diagnostik und Therapie der Magenkrankheiten," a drawing of the stomach-electrode generally in use, which consists, as described above, of a stomach-tube, through which runs a fine spiral wire ending in a metallic button within the tube.

¹ Charles G. Stockton: A New Gastric Electrode, MEDICAL RECORD, November 9, 1889, p. 530.

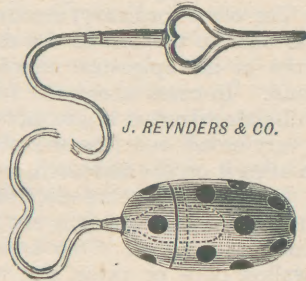
² Von Ziemssen: Ueber die physikalische Behandlung chronischer Magen- und Darmkrankheiten, p. 10. Leipzig, 1888.

³ Ewald: Klinik der Verdauungskrankheiten, p. 64. Berlin, 1889.

⁴ Charles G. Stockton: The American Journal of the Medical Sciences, July, 1890, p. 20.

⁵ Boas: Allgemeine Diagnostik und Therapie der Magenkrankheiten, p. 239. Leipzig, 1890.

In order to facilitate the internal or direct electrization of the stomach I have constructed an electrode on the same principle as the stomach bucket designed by me.¹ This electrode once swallowed reaches the stomach without further artificial aid. The silk thread of the bucket is represented in the electrode by a very fine (1 mm. in diameter) rubber tube through which a very fine, soft, conducting wire runs to the battery. The end-piece of the electrode consists of a hard rubber capsule (of the same size and shape as the stomach bucket) with many openings. In this capsule lies a metallic button which is connected with the wire. (Figure shows the electrode in natural size).



The rubber capsule serves to avoid the direct contact of the metal with the stomach-wall; the circuit is completed in the same way as in Bardet's electrode, by the water the stomach contains.

This electrode might be aptly designated a "Deglutible Stomach Electrode."²

Method: The patient drinks, best when in a fasting condition, one to two glasses of water (tea, coffee, or beer). The patient has now to open his mouth widely, and the electrode (the capsule piece) is placed far behind on the root of the tongue and he is ordered to swallow. He again drinks some water, and the electrode finds its way to the stomach without any further assistance.

In order to recognize this point precisely, it is advisable to make some mark on the cord at a distance of 40 ctm.

¹ M. Einhorn: MEDICAL RECORD, July 19, 1890.

² The Deglutible Stomach Electrode is manufactured by John Reynders & Co., 303 Fourth Avenue, New York.

from the capsule; as soon as this mark comes to the teeth we are sure that the electrode is in the stomach and we can apply the electricity to the patient.

The other (ordinary) electrode is best placed either on the back to the left of the seventh dorsal vertebra, or in front at the epigastric region, or is simply held in the hand. In cases where the stomach and intestines have to be electrized, it is advisable to use as second electrode a very broad one (the so called "plate electrode"), and to keep it on the abdomen.

In withdrawing the electrode a resistance is felt at the introitus œsophagi; it is not advisable to pull the electrode with force. One has only to make the patient swallow once or twice, and to make use of the moment when the larynx, by this act, ascends and the passage becomes free, to withdraw the electrode, which is done now with perfect ease.

Direct electrization of the stomach by means of the deglutable electrode is very simple and handy for the patient and for the physician, and, as it seems to me, as easy to apply as percutaneous electrization. Considering the great rôle electricity plays in medicine as a therapeutic means, it has been perhaps to a certain degree neglected in the treatment of stomach and intestinal disorders, because a handy method for the direct electrization of the stomach was wanting.

I hope after a while to be able to give a detailed account of the physiological effects of direct electrization of the stomach in man. To-night I would like to describe a few experiments which tend to prove that the gastric-juice secretion is increased by direct electrization of the stomach.¹

The investigations have been made in the following way: Three persons not having any complaints in reference to their digestion were examined, when fasting, with

¹ Remark: As regards the physiological action of direct electrization of the stomach in man, there have been as yet, so far as I could see from the literature, no investigations made.

the tube, in order to see whether the stomach was empty or not, and if not, then it was emptied. Thereupon each one of them drank 100 or 160 c.c. of water and swallowed the stomach electrode, electricity, however, not being applied. After ten minutes the electrode was withdrawn and the stomach contents emptied by means of a tube, and examined in regard to hydrochloric acid and to the degree of acidity. Thereupon the same trial-subjects had to drink again the same quantity of water, and the stomach was now faradized (the deglutable electrode being in the stomach, the other in the left hand) not very strong for ten minutes; then the contents were obtained, examined, and compared with the first portions.

The trials were as follows :

I.—T. N——, physician, twenty-eight years of age ; September 10, 1890 ; when fasting ; stomach empty.

1. Drinks 100 c.c. of water and swallows the electrode. After ten minutes the electrode is withdrawn, and about 50 c.c. of the stomach contents are obtained. Reaction = acid ; HCl + weak ; acidity = 12.

2. Drinks 100 c.c. of water, swallows the electrode and gets faradized for ten minutes. The electrode is thereupon withdrawn and 40 c.c. are obtained by means of a tube. Reaction = acid ; HCl + ; acidity = 16.

II.—T. S——, fifty years of age ; September 23, 1890 ; when fasting ; stomach contains about 5 c.c. of mucous secretion, with presence of HCl.

1. Drinks 160 c.c. of water and swallows the electrode. Ten minutes later the electrode is withdrawn and 140 c.c. obtained. Reaction = weakly acid ; HCl with Congo = no reaction, with Günzburg's test = ? ; acidity = 4.

2. Drinks 160 c.c. of water and is faradized. After the swallowing of the electrode, for ten minutes the obtained quantity = 170 c.c. Reaction = acid ; HCl, Congo paper turns blue on the margin, Günzburg's test = + (even when twice diluted) ; acidity = 8.

III.—H. R——, twenty-two years of age ; September

24, 1890 ; when fasting. There were obtained 3 to 5 c.c. of stomach secretion, with $\text{HCl} = 0$.

1. Drinks 100 c.c. of water, and swallows the electrode. Ten minutes later there were obtained by the tube — 80 c.c. $\text{HCl} +$; acidity = 8.

2. Drinks 100 c.c. of water, and is faradized. After swallowing the electrode for ten minutes the obtained quantity = 100 c.c. Reaction = acid ; $\text{HCl} +$; acidity = 12.

In all three experiments we find a higher degree of acidity in the second part of each trial, when faradization was applied, than in the first part, during which everything had been done just in the same way minus electricity. The conclusion that the faradic current increases the production of the gastric juice, therefore, seems to be justifiable.

As to the clinical cases treated after this method of direct electrization of the stomach, I would not like to trouble you at present with detailed accounts. However, I cannot abstain from giving you in a few words a *résumé* of my clinical experiences since September last.

The direct faradization of the stomach has been applied in :

(a) Three cases of hyperacidity ; (b) five cases of dilatation of the stomach (caused by insufficiency of the motor power) ; (c) five cases of chronic gastric catarrh (or, more correctly, of gastritis chron. gland.) with diminished acidity ; (d) one case of atrophy of the mucous membrane of the stomach.

The galvanic current has been applied internally in two cases of very severe gastralgia.

The most marked results have been obtained in all cases of dilatation, and in the grave cases of chronic gastric catarrh. The ameliorated condition was not only a subjective one, but could often be proven also objectively by the change in the chemical analysis of the stomach contents. In two cases of very aggravated chronic gastric catarrh, in which free hydrochloric acid could never

be found after the test-meals, the same could easily be detected after the stomach had been faradized internally for ten minutes.

The majority of cases of hyperacidity (not combined with dilatation) likewise showed an improved condition. Here, by electricity alone, I seldom succeeded in diminishing the abnormally high degree of acidity. In order to fulfil this purpose I had to give the alkalies in the usual way.

The two cases of pure gastralgia showed an amelioration from the constant current, *i.e.*, first a decrease and then a disappearance of the attacks of pain, after the current had been applied for about two or three weeks, although it is certainly impossible to say for how long after such an electric cure the gastralgia will not reappear.

From the above it is evident that we possess in the direct electrization of the stomach a very potent means of overcoming certain abnormal conditions, and thereby permitting the functions of the stomach to adjust themselves to the normal. Let me, therefore, hope that this easy way of applying electricity directly to the stomach by means of the deglutable electrode, will tend to bring this remedy more into use among the medical profession.

